IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor: Yoshitaka DANSUI et al. Art Unit: 1746

Appln No.: 09/805,509 Examiner: G. Winter

Filed: March 14, 2001

For: NICKEL POSITIVE ELECTRODE ACTIVE MATERIAL AND NICKEL METAL HYDRIDE STORAGE BATTERY

DECLARATION UNDER 37 CFR 1.132

I, Yoshitaka DANSUI, do HEREBY DECLARE that:

I am an inventor of the above-referenced patent application and an employee of the Assignee of this application, Matsushita Electric Industrial Co., Ltd.

I have an understanding and direct knowledge of the comparative test performed in accordance with the process described below. This test compared the performances of a battery produced in accordance with the invention of the above-referenced patent application (battery A of page 10, line 6, page 12, line 1) and a control battery produced according to a related art method (battery X of page 12, line 4 et seq. of the above-referenced patent application). The method of producing each battery is described below and the attached Fig. 1 illustrates the operational performance of each battery.

Process for Developing Battery A of the Invention:

Five grams (g) of yttrium oxide was added to 200 cm^3 of 30 wt% aqueous sodium hydroxide solution, and the mixture was stirred to produce a suspension. One hundred cubic centimeters (cm^3) of 20% aqueous sodium hypochlorite solution was gradually added to the suspension. After a bubbling of oxygen was completed, the solution was filtered and the precipitate was washed with water. The precipitate was dried with a vacuum drier to provide a yttrium hydroxide precursor.

Next, 300 g of nickel hydroxide powders, 30 g of cobalt hydroxide powders, 6 g of zinc oxide, and 3 g of the yttrium hydroxide precursor powder were mixed to prepare a paste. A foamed metal was filled with a part of the paste. Thereafter, the foamed metal and paste were dried and rolled to make a positive electrode plate. After rolling, the positive electrode plate had a thickness of about 750 μm. A theoretical capacity of the electrode was 1300 mAh (the theoretical capacity was calculated based on nickel hydroxide as having 289mAh/g, assuming that nickel hydroxide causes one electron reaction).

Then, a paste for a negative electrode was prepared by mixing a hydrogen-absorbing alloy of AB_5-type with 1 wt% of a carbon material, 1 wt% of PTFE, and water. The paste was coated on a foamed metal, followed by drying and rolling. A thickness of the negative electrode thus prepared was 420 μm after rolling. The electrode had a theoretical capacity of 1900 mAh.

As a separator, nonwoven fabric made of polypropylene was used. A thickness of the separator was 130 μm.

These positive and negative electrodes and the separator were disposed in the order of positive electrode, separator, negative electrode, and separator. Together, these components were rolled in a spiral form and encased in an AA battery case. The case was filled with a given volume of an alkali electrolyte solution. Thereafter, the case was sealed at the upper part with a sealing plate to make a sealed type nickel metal hydride storage battery.

The battery was charged at 130 mA in a temperature environment of 25°C for 15 hours and then discharged at 260 mA until the discharge voltage reached 1V. A utilization ratio (the ratio of actual discharge capacity/theoretical capacity of the positive electrode) determined from the discharge capacity under the given conditions was 98%. This battery is referred to as battery A of the present invention.

Process for Developing Comparative Battery X:

Three hundred grams of nickel hydroxide powders, 30 g of cobalt hydroxide powders, 6 g of zinc oxide, and 3 g of yttrium oxide were mixed to prepare a paste. A foamed metal was filled with a part of the paste, and, thereafter, the foamed metal and paste were dried and rolled to make a positive electrode plate. After rolling, the positive electrode plate had a thickness of about 750 μm. A theoretical capacity of the electrode was 1300 mAh (the theoretical capacity was calculated based on nickel hydroxide as having 289mAh/g, assuming that nickel hydroxide causes one electron reaction).

Then, a paste for a negative electrode was prepared by mixing a hydrogen-absorbing alloy of AB_5-type with 1 wt% of a carbon material, 1 wt% of PTFE, and water. The paste was coated on a foamed metal, followed by drying and rolling. A thickness of the negative electrode thus prepared was 420 μm after rolling. The electrode had a theoretical capacity of 1900 mAh.

As a separator, nonwoven fabric made of polypropylene was used. A thickness of the separator was 130 μm.

These positive and negative electrodes and the separator were disposed in the order of positive electrode, separator, negative electrode, and separator. Together, these components were rolled in a spiral form and encased in an AA battery case. The case was filled with a given volume of an alkali electrolyte solution. Thereafter, the case was sealed at the upper part with a sealing plate to make a sealed type nickel metal hydride storage battery.

The battery was charged at 130 mA in a temperature environment of 25°C for 15 hours and then discharged at 260 mA until the discharge voltage reached 1V. A utilization ratio (the ratio of actual discharge capacity/theoretical capacity of the positive electrode) determined from the discharge capacity under the given conditions was 98%. This battery is referred to as comparative battery X.

Performance Comparison:

Batteries A and X were charged at 130 mA in temperature environments of 25°C, 45°C, 50°C, 55°C and 60°C, respectively. The temperature was then lowered to 25°C and the batteries were discharged at 260 mA.

Fig. 1 of the above-referenced application (attached hereto for convenience) shows the utilization ratios of the batteries at each temperature. As may be determined by inspection of Fig. 1, battery A of the present invention was more efficiently charged at elevated temperatures and, therefore, provided greater discharge capacity than did comparative battery X.

I, the undersigned, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Signed this 19th day of April, 2004.

Yoshitaka Dansui

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FIG. 1